Rapid HIV Antibody Testing During Labor and Delivery for Women of Unknown HIV Status

A Practical Guide and Model Protocol

Rapid HIV-1 Antibody Testing During Labor and Delivery for Women of Unknown HIV Status

A Practical Guide and Model Protocol

January 30, 2004

Margaret Lampe
Division of HIV/AIDS Prevention (DHAP)
National Center for HIV, STD, and TB Prevention (NCHSTP)
Centers for Disease Control and Prevention (CDC)
Atlanta, Georgia

Bernard Branson
DHAP, NCHSTP, CDC

Sindy Paul
Division of AIDS Prevention and Control
New Jersey Department of Health and Senior Services
Trenton

Carolyn Burr
François-Xavier Bagnoud Center
University of Medicine & Dentistry of New Jersey
Newark

Elaine Gross
François-Xavier Bagnoud Center
University of Medicine & Dentistry of New Jersey
Newark

Cynthia Eicher
Medical Center of Louisiana Blood Bank
New Orleans

Robert Maupin
Department of Obstetrics and Gynecology
Louisiana State University School of Medicine
New Orleans

Dawn Averitt
The Well Project
Asheville, North Carolina

Brian Forsyth
Department of Pediatrics
Yale University School of Medicine
New Haven, Connecticut
and

Mary Glenn Fowler
DHAP, NCHSTP, CDC

Contents

Introduction

Effective interventions are available to reduce the rate of perinatal HIV transmission when women are identified as HIV infected early in pregnancy. Pregnant women who are HIV infected but who do not receive prenatal care or do not receive an HIV test during prenatal care are not identified as HIV infected and therefore miss opportunities to reduce the risk of transmission to their infants and to receive life-saving treatments for themselves. With the implementation of screening programs using rapid HIV testing in labor and delivery settings, women with unknown HIV test results during prenatal care (results not documented in the prenatal medical record) can learn their HIV status quickly and receive short-course antiretroviral (ARV) prophylaxis to dramatically reduce the risk of transmitting HIV to their infants. The Centers for Disease Control and Prevention (CDC) recommends routine rapid HIV testing using an opt-out approach for women in labor whose HIV status is unknown (see Dear Colleague Letter, Appendix A).

As a result of a congressional mandate contained in the Ryan White CARE Act Amendments of 2000 that a study should be conducted of perinatal HIV transmission in the United States, the Office of the Inspector General (OIG) issued a 2002 report entitled "Reducing Obstetrician Barriers to HIV Testing."[1] One of the recommendations in the report is that "CDC should facilitate the development and states' implementation of protocols for HIV testing during labor and delivery in order to promote testing in this setting as the standard of care." Implementing rapid testing and short-course ARV prophylaxis in labor and delivery settings is feasible, but as is true when implementing any new screening program and clinical intervention, there are challenges. CDC has established a working group of 10 persons with expertise in obstetrics, pediatrics, public health practice, nursing, health education and training, blood screening and laboratory science, epidemiology, and rapid HIV testing technology to develop this model protocol for rapid HIV screening for women in labor. The working group represents academic institutions and university hospitals, a peer advocacy and support organization for women living with HIV infection, state and federal health agencies, as well as an internationally recognized HIV training and education organization. Each member of the group brings diverse experiences with rapid HIV testing to this document. The committee recognizes that as rapid HIV testing is more routinely implemented in labor and delivery settings, more knowledge will be gained. This guide will therefore be maintained as a "living document" and will be regularly updated and maintained on the CDC Web sites; it can be viewed on the perinatal HIV prevention site (www.cdc.gov/hiv/projects/perinatal/) and the rapid HIV testing site (www.cdc.gov/hiv/rapid_testing).

I. Background on Rapid Testing During Labor and Delivery

Tremendous medical and public health achievements have been made in the prevention of mother-to-child transmission (MTCT) of HIV-1. The risk for infant infection has been reduced from approximately 25% to less than 2% by the use of currently recommended prenatal ARV and obstetric interventions for a woman who is aware of her HIV infection early in pregnancy.

Ideally, all women should be screened for HIV before delivery, during an initial prenatal care visit so that potent combination antiretroviral treatment can be given to women who are HIV-infected. However, according to the CDC, approximately 40% of the mothers of the estimated 280–370 HIV-infected infants born in 2000 were not known to have HIV infection before delivery.[1] It is critical to greatly reduce these missed opportunities for identifying HIV-infected pregnant women during the prenatal period, when the most effective interventions can be delivered.

According to clinical trial data, ARV prophylaxis, even when begun during labor and delivery and then given to the neonate, can reduce MTCT of HIV as much as 50%.[2-6] To maximize this benefit, it is of utmost importance to obtain HIV test results for women in labor as soon as possible. Timely rapid HIV test results may allow providers to avoid some common obstetric practices that may increase the risk of transmission (e.g., artificial rupture of membranes, amniocentesis, or sampling of blood from the fetus's scalp), and they can also advise the mother not to breastfeed.[7]

Routinely offering rapid HIV testing to women whose HIV status is unknown during labor and delivery provides the opportunity to reduce transmission even among women who do not seek care until labor begins. The rapid HIV test kits now licensed in the United States allow test results to be available in 20 minutes or less. Results from the OraQuick Rapid HIV-1 Antibody Test (OraSure Technologies, Inc., Bethlehem, Pennsylvania) can be read within 20–40 minutes, and results from the Reveal Rapid HIV-1 Antibody Test (MedMira Laboratories, Inc., Halifax, Nova Scotia) can be read in approximately 5–10 minutes after test procedures are begun. Findings from the CDC-sponsored Mother-Infant Rapid Intervention at Delivery (MIRIAD) study indicate that offering voluntary HIV testing during labor is feasible in obstetric settings and that the OraQuick Rapid HIV-1 Antibody Test, used on whole blood specimens, delivers accurate and timely test results.[8]

The purpose of this document is to offer guidance and practical tips to clinicians, laboratorians, hospital administrators, and policymakers who are planning and implementing a program for HIV rapid testing during labor and delivery for women of unknown HIV status and to provide the general structure of a model rapid HIV testing protocol that can be adapted by staff at facilities that seek to implement rapid testing during labor and delivery. For additional background on perinatal HIV prevention, see References, Other Suggested Reading, and Resources.

II. Planning and Implementing a Rapid HIV Testing Program for Women in Labor: Points to Consider in Preparing to Develop a Rapid HIV Testing Protocol

A. Location of Testing: in the Laboratory or in the Labor and Delivery Unit?

The U.S. Food and Drug Administration (FDA) recently approved a 1-step rapid HIV test that can be performed with whole blood either in the laboratory or at the point of care, that is, in the labor and delivery unit.[9] With this test, it is possible to obtain results in as little as 20 minutes from the time the specimen is collected. In practice, based on data from the MIRIAD study at 1 site, median turn-around time for test results was 45 minutes in hospitals where testing was performed in the labor and delivery unit, and 3 1/2 hours when specimens were sent to the laboratory.[10]

Deciding where to conduct rapid HIV testing depends on a number of factors, including logistics in the labor and delivery unit, availability of trained staff, the capacity of the laboratory to consistently convey rapid HIV test results quickly (optimally in less than 60 minutes),[10] and the Clinical Laboratory Improvement Act (CLIA) categorization of the test device. The OraQuick Rapid HIV-1 Antibody Test is designated by CLIA as waived and can be performed in the labor and delivery unit; the Reveal Rapid HIV-1 Antibody Test is designated under CLIA as moderate-complexity and must therefore be performed in a laboratory.

Point-of-care testing requires training and continual supervision to ensure competent and proficient testing. This requirement can pose a challenge, especially if staff turnover is high. When rapid testing is performed in the laboratory, attaining consistently prompt results requires the availability of 24-hour staff responsive to the urgent need for immediate HIV test results. Choosing the location for rapid testing may be best accomplished after a needs assessment during labor and delivery and consultation with the hospital's point-of-care testing committee. (See section IV for the training essentials for point-of-care testing.) The College of American Pathologists Commission on Laboratory Accreditation has published a point-of-care testing checklist, which is used as part of its accreditation process. The checklist, which may help to guide the point-of-care testing process in labor and delivery settings, is available at www.cap.org/apps/docs/laboratory_accreditation/checklists/checklistftp.html.

B. Interpretation of Test Results: What Does a Positive Rapid HIV Test Result Mean?

The accuracy of diagnostic tests is expressed in terms of sensitivity and specificity, as well as the positive and negative predictive value of the test result. No test is both 100% sensitive (no false-negative test results) and 100% specific (no false-positive test results). Screening tests are designed to be highly sensitive to ensure that no infected person is missed. The price for this high sensitivity is a slightly reduced specificity, that is, some women who are not infected with HIV will have false-positive HIV screening test results. In addition, the positive predictive value of a test depends on the prevalence of the condition in the group being screened. In a setting where prevalence is high, a positive result from a screening test is much more likely to reflect the person's true status than is a positive result in an area of low prevalence, where a higher percentage of positive results will be false-positives. In all settings, a positive rapid HIV test result is a preliminary positive result that requires confirmation.

Provisions, therefore, must be made to confirm all preliminary positive rapid HIV test results, as soon as possible, with a supplemental test such as the Western blot or immunofluorescent assay (IFA). However, such testing can take several days or more and does not satisfy the need for timely HIV test results for women in labor. Thus, even in optimal rapid testing programs, some women who are not infected will receive ARV prophylaxis on the basis of a false-positive result from a rapid HIV test. The seriousness of the psychological effect of such a result is self-evident. However, a short course of the ARV prophylaxis currently recommended by the US Public Health Service has no known long-term safety effects for women and infants who are not infected.[11] Observational studies and clinical trials have shown that when ARV prophylaxis is administered during labor or within the first 12 hours after birth, the risk of perinatal HIV transmission is reduced from 25% to 9%–13%.[2-6] In addition, diagnosing HIV infection during labor and delivery provides a window of opportunity to offer infected women referral and treatment for their own care.

C. Importance of System to Ensure Labor Staff Access to Prenatal HIV Test Results

Experience at several hospitals has shown that HIV testing has often been done during the prenatal period but that results have not been available to labor and delivery staff. The lack of access to prenatal test results thus leads to unnecessary rapid testing and increases the potential for false-positive results and unnecessary ARV prophylaxis. During planning for the implementation of a protocol for rapid testing during labor, it is critical to ensure that all results of HIV testing during pregnancy are documented in the woman's prenatal record and readily available to labor and delivery staff. Ensuring the availability of prenatal results may require coordination with other antenatal health care facilities to make sure that the pregnant woman signs a medical release and that her prenatal records are routinely and promptly transferred to the delivery facility before the woman's due date.

D. Choosing the Type of Rapid HIV Testing to Use

Four rapid tests approved by the U.S. Food and Drug Administration (FDA) can provide rapid results during labor and delivery: the OraQuick Rapid HIV-1 Antibody Test (OraSure Technologies, Inc., Bethlehem, Pennsylvania), the Reveal Rapid HIV-1 Antibody Test (MedMira Laboratories, Inc., Halifax, Nova Scotia), the Uni-Gold Recombigen HIV Test (Trinity Biotech Plc., Co Wicklow, Ireland) and the Murex-SUDS-Single Use Diagnostic System HIV-1 Antibody Test (Abbott Laboratories, Abbott Park, Illinois). The SUDS test is no longer available because manufacture was discontinued in 2003.

When selecting a rapid HIV test for use during labor and delivery, it is important to consider the accuracy of the test and the location within the institution at which testing will be performed. Tests that require serum or plasma (i.e., Reveal and SUDS) are more suitable for use in the laboratory because of the need to centrifuge the blood specimen, whereas tests that can be performed with whole blood (e.g., OraQuick, Uni-Gold) without specimen processing are more easily performed in the labor and delivery unit. The sensitivities and specificities, according to clinical licensure data submitted to the FDA, are shown in Table 1.

Table 1. FDA-approved Test Performance, by Specimen Type*

Test	Specimen Type	Sensitivity, % (95% C.I.)	Specificity, % (95% C.I.)	CLIA complexity
OraQuick	Whole blood**	99.6 (98.5-99.9)	100 (99.7-100)	Waived
	Serum	—	—	—
	Plasma	—	—	—
	Oral Fluid	—	—	—
Reveal	Whole blood	—	—	—
	Serum	99.8 (99.2-100)	99.1 (98.8-99.4)	Moderate
	Plasma	99.8 (99.0-100)	98.6 (98.4-98.8)	Moderate
Uni-Gold	Whole blood^	100 (99.5-100)	99.7 (99.0-100)	Moderate
	Serum	100 (99.5-100)	99.8 (99.3-100)	Moderate
	Plasma	100 (99.5-100)	99.8 (99.3-100)	Moderate
SUDS	Whole blood	—	—	—
	Serum	99.9 (—)	99.6 (—)	Moderate
	Plasma	99.9 (—)	99.6 (—)	Moderate

* Data from FDA summary basis of approval
** Fingerstick and venipuncture
^ Venipuncture only

Note: SUDS has not been available since August 2003.

Because HIV prevalence among pregnant women is low in many parts of the United States, a test with high specificity will minimize the number of false-positive results. Comparisons of the positive predictive values of several FDA-approved HIV-1 antibody tests in populations with differing HIV prevalence rates are shown in Table 2.

Table 2. Positive Predictive Value of a Single Screening Test for HIV in Populations with Differing HIV Prevalence*

	Estimated Positive Predictive Value, %				
HIV Prevalence, %	OraQuick (blood)	Reveal (serum)	Uni-Gold (blood)	Single EIA	SUDS (serum)
10	100	92	97	98	96
5	100	85	95	96	91
2	100	69	87	91	80
1	100	53	77	83	67
0.5	100	36	63	71	50
0.3	100	25	50	60	38
0.1	100	10	25	33	18

*Based on point estimate for specificity from FDA summary basis of approval. In practice, the specificity and actual PPV may differ from these estimates.
Note. Trade names are for identification purposes only and do not imply endorsement by the US Department of Health and Human Services or the Centers for Disease Control and Prevention. EIA, enzyme immunoassay; SUDS, Single Use Diagnostic System.

Based on the specificity observed in clinical licensure trials, the number of false-positive results would be substantially fewer with OraQuick than with either a single enzyme immunoassay, Uni-Gold or the Reveal rapid test. In fifteen hospitals participating in the MIRIAD study, the prevalence of HIV ranged from 0.3% to 3% among women with unknown HIV status who consented to HIV testing in labor and delivery.

E. Training Labor and Delivery Staff in Rapid Testing

Whether or not point-of-care testing is performed, labor and delivery staff will be called upon to provide women in labor whose HIV status is unknown with information on the availability of rapid HIV testing and perinatal HIV prevention and also to inform them that they will be tested unless they decline. (See section IV. for training essentials for persons performing the test.)

III. Key Elements of a Model Protocol for Rapid Testing during Labor and Delivery

A. Determining Eligibility for Rapid HIV Testing

The prenatal records of all women presenting to the labor and delivery unit should be reviewed for documentation of an HIV test result during the current pregnancy. Any woman without documentation of an HIV test result during the current pregnancy should be routinely screened for HIV by the use of a rapid HIV test and an opt-out approach (see section III. C). Including a standing order (e.g., "provide routine rapid HIV testing if there is no documentation of prenatal HIV test results unless the woman declines") as part of the admission orders for women in labor may also save valuable time. Clinicians may use an opt-out approach to rapid HIV testing to re-screen women with documented negative HIV test results during the current pregnancy if there are indications that the woman is at continued risk for HIV infection (e.g., a history of sexually transmitted diseases [STDs], exchange of sex for money or drugs, multiple sex partners during the current pregnancy, use of illicit drugs, sex partner[s] known to be HIV-positive or at high risk, or signs and symptoms of seroconversion). This approach is similar to that used for syphilis screening, in which retesting for syphilis during the third trimester and again at delivery is recommended for pregnant women at high risk.[13] Some states mandate syphilis screening at delivery for all pregnant women. Routine universal retesting for HIV by the use of an opt-out approach should be considered in health care facilities in areas with high HIV seroprevalence among women of childbearing age.[14]

B. Ensuring Confidentiality of Pregnant Women

Protecting the confidentiality of the pregnant woman who receives HIV testing during labor is required both by ethical standards and legal requirements. However, in the busy and complex labor and delivery unit, maintaining confidentiality requires that staff members be knowledgeable and vigilant. The following are practical tips to help protect the confidentiality of women who receive rapid HIV testing during labor and delivery:

- Discuss HIV testing when the woman is alone and feels safe to answer honestly: spouses, partners, and other family members may not know her sexual, reproductive or HIV testing history and this information should not be disclosed to them.
- Set up services as part of the rapid testing protocol to make available a professional interpreter, rather than family members, to protect the confidentiality of women who do not speak English.
- Ask the woman in labor ahead of time whom, if anyone, she would like present when the results of the HIV test are provided. Confidentiality should be maintained when giving results, and only the persons the woman has indicated should be present when the test results are provided.
- Ensure confidentiality when discussing ARV prophylaxis if the test result is positive.
- Label intravenous ARV medications in a way that protects confidentiality.

- Develop and implement procedures to ensure the confidentiality of HIV test results received in the labor and delivery unit. Some hospitals maintain a logbook in which to record the following information: the patient's medical record number, date and time that the HIV test is done in the unit or sent to the laboratory, date and time the test results are received, and notation that the test results have been documented in the chart or communicated to the postpartum unit if the patient has given birth and been transferred. The system should both maintain confidentiality and ensure that results are communicated promptly to clinical staff.

C. Suggested Approaches to Routine Rapid HIV Testing during Labor and Delivery for Women of Unknown HIV Status: Considerations in Implementing the Opt-out Approach

CDC recommends routine rapid HIV testing for women in labor whose HIV status is unknown (women with no documentation of a prenatal HIV test in their medical records) unless they decline testing, that is, unless they opt out (Appendix A, CDC, Dear Colleague Letter, April 22, 2003; also available at: http://www.cdc.gov/hiv/PROJECTS/perinatal/2003/letter.htm). CDC also recognizes that regulations, laws, and policies regarding the HIV screening of pregnant women and neonates are not standardized throughout US states and territories. Health care providers and other hospital staff developing a rapid testing protocol for their facility should be familiar with, and adhere to, state and local laws, regulations, and policies concerning the HIV screening of pregnant women and neonates. They should document in the medical chart the results of all tests, both the rapid and the confirmatory. If a woman in labor and of unknown HIV status refuses rapid HIV screening, her refusal should likewise be noted in the medical chart.

The following information should be given to a woman in labor whose HIV status is unknown so that she has sufficient information to make an informed decision about screening:

1. She should be informed that the HIV virus can be transmitted from a mother to her infant during pregnancy, during labor and delivery, and through breastfeeding and that effective interventions during labor and after birth can substantially reduce the risk that her baby will become infected.
2. She should be informed that rapid HIV testing will be done routinely to help protect her infant's health unless she declines testing.
3. She should be informed that a negative rapid HIV test result means that she is most probably not HIV infected, but that the test cannot detect very recent infection or recent exposure. A positive rapid test result is preliminary and a confirmatory test will need to be done.
4. She will be offered medicines right away for both her and her baby to reduce the chance that her baby will become infected. If the confirmatory test is also positive, she will be offered medical care for her own health.

All efforts should be made to determine a mother's HIV status **as soon as possible** during labor. If the mother's HIV status remains unknown at delivery, she or the infant or both should have rapid HIV testing as soon as possible postpartum. Some states mandate HIV screening of the neonate in this circumstance; however no states mandate screening of mothers.

Providing information about HIV infection to women in labor whose HIV status is unknown and routinely conducting rapid HIV testing are challenging, but the obstacles can generally be overcome with a thoughtful and systematic approach.

CDC recommends routine rapid HIV testing by the use of an opt-out approach, in which women are informed that HIV testing will be routinely done if her HIV status is unknown during labor and delivery but that she may decline testing (Appendix A,CDC, Dear Colleague Letter, April 22, 2003, available also at: *http://www.cdc.gov/hiv/PROJECTS/perinatal/2003/letter.htm*). (For an example of a script for an opt-out approach, see Appendix B.) Recognizing that some jurisdictions may still require written, signed informed consent for HIV testing, a sample written informed consent document (opt-in; also included in Appendix B) may be useful during the transition to routine HIV testing during labor and delivery.

The François-Xavier Bagnoud Center (FXBC), of the University of Medicine and Dentistry of New Jersey is an internationally recognized organization dedicated to improving the lives families infected and affected by HIV infection. FXBC has developed a formula for offering routine rapid testing. (For an adaptation of this forumla, see Appendix C, which incorporates both the content that must be covered and the process still required by some state laws.)

D. Currently Approved Rapid HIV Test Kits

Two of the 4 rapid HIV antibody tests currently approved by the FDA are available for clinical use: the OraQuick Rapid HIV-1 Antibody Test and the Reveal HIV-1 Antibody Test. The Uni-Gold Recombigen HIV Test is expected to become available shortly. The availability of rapid HIV tests will change as new devices are developed and approved by the FDA and marketed by manufacturers. Information on the availability of rapid HIV tests is routinely updated on the CDC Web site, at *www.cdc.gov/hiv/rapid_testing/* and is also available on the FDA Web site, at *http://www.fda.gov/cber/products/testkits.htm*. The manufacturer's instructions for rapid HIV tests should be strictly followed.[15,16]

E. Interpreting Preliminary and Confirmatory Testing Results

Test results from rapid HIV tests are interpreted the same as other HIV screening test results.

- A negative result from a single test is considered negative. However, if the person being tested may have been exposed to HIV within the past 3 months, a repeat test at a later time is recommended because the rapid antibody test may not show very recent infection.
- A positive (or reactive) result from a rapid HIV test is considered a preliminary positive and must be followed up with a confirmatory test, either a Western blot or an immunofluorescence assay (IFA). Confirmatory testing should be done as soon as possible.
- When the results of a rapid test and a confirmatory test are discrepant, both the rapid and confirmatory test should be repeated, and consultation with an infectious disease specialist is recommended.

F. Providing Results

When the rapid HIV test is discussed, the woman should be told how soon to expect the results. Usually, test results will be available before delivery and are given to the woman during labor, at which time she is asked to consent to antiretroviral prophylaxis if the preliminary result is positive. A woman may state that she doesn't want to be told the result of the rapid HIV test until after the baby's birth. In such an instance, consent for the initiation of prophylaxis should be obtained when testing is discussed. If possible, the clinician who discussed the HIV test should give the results.

Privacy during the discussion of test results is essential to ensure confidentiality. The woman's physical comfort should be assessed and monitored while she is being given test results.

Providing NEGATIVE rapid HIV test results

If the rapid test result is negative, no further medical intervention is necessary. The woman should be told that that she is most likely not infected with HIV but that the test may not show recent infection. The clinician should ask whether she is concerned about any recent specific risk of exposure; if she is concerned, the clinician should recommend retesting after 3 months if indicated. More extensive HIV counseling should be set up for her during the postpartum period, and she should be told of these arrangements.

Providing POSITIVE rapid HIV test results

If the rapid HIV test result is positive, the clinician should tell the woman that she is likely to have HIV infection and that the baby may be exposed to HIV. She should be assured that a second test is being done right away to confirm the rapid test result but that the results will not likely be available before delivery. The clinician should explain that the rapid test result is preliminary and that false-positive results are possible but that it would be best to start ARV prophylaxis as soon as possible to reduce the risk of HIV transmission to the baby. The medication regimen that will be offered to the woman and her baby should be explained, including the known effects and possible adverse effects, and she should be given the opportunity to ask questions before accepting it. She should also be told to postpone breastfeeding until the confirmatory results are available because she should not breastfeed if she is HIV infected. The clinician should explain that all ARV prophylaxis will be stopped if the confirmatory test result is negative.

Preliminary results may not be available before delivery if labor is rapid or the woman is admitted to the unit late in labor. If the preliminary HIV test result is positive, ARV prophylaxis for the neonate should be initiated as soon as possible. (See Section G, for information on peripartum clinical management, scenario 4)

If the confirmatory HIV test result is positive, antiretroviral prophylaxis for the infant, to help prevent perinatal transmission, will be continued.

If the rapid HIV test result is positive, complicated and sensitive information needs to be explained privately to the woman during labor, a very vulnerable time. The clinician should allow time for questions and assure her that with her permission, every measure will be taken to reduce the infant's risk of acquiring HIV. She should also be reassured that effective treatment is available to help keep her healthy while she is raising her child.

In some settings, the results of the confirmatory Western blot or IFA will be available after the mother and her infant are discharged from the hospital. As part of discharge planning, the woman should be informed of the importance of returning to discuss her confirmatory test result so that both she and her infant can receive appropriate medical care. A system for contacting women who miss appointments to receive their confirmatory test results is important, especially for women who did not receive prenatal care. Involving family members or other support persons in discharge planning

can be helpful if the woman agrees to their participation and has disclosed her rapid HIV test results to them.

G. Peripartum Clinical Management of Women with Positive Rapid HIV Test Results

The US Public Health Service Perinatal HIV Guidelines Working Group publishes Recommendations for Use of Antiretroviral Drugs in Pregnant HIV-1–Infected Women for Maternal Health and to Reduce Perinatal HIV-1 Transmission in the United States. The recommendations are available as a living document (frequently updated) at *www.aidsinfo.nih.gov/guidelines/*. Given the potential complexity of the clinical management decisions, it is strongly encouraged that local protocols for peripartum intervention for women whose HIV infection is diagnosed during labor be developed in consultation with HIV/infectious disease experts.

The current recommendations (version dated November 26, 2003) present 4 clinical scenarios and ARV treatment recommendations to reduce perinatal transmission. Scenarios 3 and 4 (summarized in the following sections) apply to women who arrive in a labor and delivery with undocumented HIV status and who have positive rapid HIV test results. In initiating rapid HIV testing and treatment protocols, hospital staff should access *www.aidsinfo.nih.gov/guidelines/* to ensure that they follow the most recently updated recommendations. When hospital policy is being developed, input from clinicians with expertise in perinatal HIV management is encouraged.

HIV-infected women in labor with no prior treatment

(The following is a summary of scenario 3 from the USPHS guidelines.)
Several effective ARV treatment regimens are available, including (1) zidovudine (ZDV) monotherapy, (2) ZDV plus lamivudine (3TC), (3) nevirapine (NVP) monotherapy, and (4) ZDV plus NVP. Dosing is described in Table 3.

Table 3. Antiretroviral regimens for HIV-infected women in labor with no prior therapy.

Medication(s)	Woman	Neonate
ZDV	Intrapartum IV ZDV (loading dose [2 mg/kg] for 1 hour, followed by continuous infusion [1mg/kg/hr] until delivery)	ZDV syrup (2 mg/kg) orally every 6 hours for 6 weeks, beginning 8–12 hours after birth[a]
ZDV + 3TC	ZDV (600mg) po **and** 3TC (150 mg) orally at onset of labor, followed by ZDV (300 mg) orally every 3 hours **and** 3TC (150 mg) orally every 12 hours until delivery	ZDV syrup (4 mg/kg) **and** 3TC (2 mg/kg) orally every 12 hours for 7 days
NVP	Single dose of NVP (200 mg) orally at onset of labor[b]	Single dose of NVP 2 mg/kg 48–72 hours after birth
NVP+ZDV	Intrapartum IV ZDV (loading dose [2 mg/kg] for 1 hour, followed by [1 mg/kg/hr.] until delivery) **and** single dose of NVP (200 mg) orally at onset of labor[b]	ZDV syrup (2 mg/kg) orally every 6 hours for 6 weeks, beginning 8–12 hrs after birth **and** single dose of NVP (2 mg/kg) orally 48–72 hours after birth

Note. IV, intravenous; ZDV, zidovudine; 3TC, lamivudine; NVP, nevirapine.

[a] ZDV dosing for infants of <35 weeks gestation at birth is 1.5 mg/kg/dose orally, every 12 hours, increasing to every 8 hours at 2 weeks of age if >30 weeks gestation at birth or at 4 weeks of age if <30 weeks gestation at birth.[17]

[b] If the mother received NVP less than 1 hour before delivery, the neonate should be given 2 mg/kg of oral NVP as soon as possible after birth and again at 48–72 hours.

During the immediate postpartum period, the woman should have appropriate assessments (e.g., CD4+ count and HIV-1 RNA copy number) to determine whether ARV treatment is recommended for her own health.

A description of recommended intrapartum and postpartum treatment regimens for women identified in labor (USPHS guidelines, scenario 3) is available at *www.aidsinfo.nih.gov/guidelines/* and includes data on transmission and the advantages and disadvantages of each regimen. The selection of a specific abbreviated ARV prophylaxis regimen may be based on the resources of the institution or the facility and an individualized clinical assessment of the patient. Clinicians should also weigh the potential for future NVP resistance when considering treatment options.

Infants born to mothers who have received no antiretroviral therapy during pregnancy or intrapartum (Summary of scenario 4 of the USPHS guidelines)

- The 6-week neonatal ZDV component of the ZDV chemoprophylactic regimen should be discussed with the mother and recommended for the neonate.
- ZDV for the neonate should be initiated as soon as possible after birth¯preferably within 6–12 hours.
- Some clinicians may choose to use ZDV in combination with other antiretroviral drugs, particularly if the mother is known or suspected to have ZDV-resistant virus. However, the efficacy of this approach for the prevention of transmission is unknown, and appropriate dosages for neonates are incompletely defined.
- During the immediate postpartum period, the woman should undergo appropriate assessments (e.g., CD4+ count and HIV-1 RNA copy number) to determine whether ARV treatment is required for her health. The neonate should undergo early diagnostic testing so that if the neonate is HIV infected, treatment can be initiated as soon as possible.

Note: Discussion of treatment options and recommendations should not be coercive, and the final decision about the use of ARV prophylaxis is the mother's. The selection of a specific, abbreviated course of ARV prophylaxis may be based on the resources and policies of the institution or the facility, as well as an individualized clinical assessment of the patient.

Intrapartum care

If labor progresses and membranes are intact, artificial rupture of membranes and invasive monitoring should be avoided. Labor should be managed with spontaneous rupture of membranes (SROM). Episiotomy should be avoided if clinically appropriate. Breastfeeding should also be avoided.

Cesarean section

Women diagnosed with HIV infection through rapid testing at the time of presentation for delivery will frequently present in active labor and/or with ruptured membranes. In such circumstances, information regarding maternal viral load will likely not be available to guide the management of delivery. Data are insufficient to indicate whether cesarean section (C-section) will add any benefit in reducing the risk of MTCT.[18] In the only published randomized controlled trial of c-section in HIV-infected women, rates of perinatal HIV transmission between mother-infant pairs with emergency C-section (after active labor or rupture of membranes) and mother-infant pairs with vaginal delivery did not differ.[19] However, for women whose HIV infection was diagnosed late in pregnancy and who have no evidence of labor or rupture of membranes but who have clinical indications for delivery (e.g. preeclampsia, vaginal bleeding, fetal heart rate abnormalities, intrauterine growth retardation,

oligohydramnios), c-section may help to prevent HIV transmission. Management in such circumstances should be individualized, and accepted principles should be taken into consideration:

1. The greatest benefit in preventing transmission is associated with cesarean delivery performed before the rupture of membranes or to the onset of labor in conjunction with the administration of ARV prophylaxis.
2. ARV prophylaxis should be administered to the woman before cesarean delivery whenever possible (ideally, 2–4 hours).

A more comprehensive discussion of the role of C-section in the prevention of perinatal HIV transmission is available in the U.S. Public Health Service Task Force Recommendations for Use of Antiretroviral Drugs in Pregnant HIV-1–Infected Women for Maternal Health and Interventions to Reduce Perinatal HIV-1 Transmission in the United States (*www.aidsinfo.nih.gov/guidelines/*).

Neonatal care

- The neonate should be bathed promptly after birth and before injections (e.g., vaccines or vitamin K).
- A baseline complete blood count (CBC) with differential AND serum chemistries should be performed before initiating ARV prophylaxis. A CBC should be repeated at 6 and 12 weeks of age.
- Polymerase chain reaction (PCR) testing for HIV-1 should be done at birth (before 48 hours of age) and repeated at ages 1–2 months and 3–6 months. Additional testing at 14 days of age might allow the early detection of infection.[20]

*HIV-exposed infants should be evaluated by, or in consultation with, a specialist in HIV infection in pediatric patients. Regular updates of the Guidelines for the Use of Antiretroviral Agents in Pediatric HIV Infection are available at *www.aidsinfo.nih.gov/guidelines*.

H. Communication with Pediatricians

It is crucial that the obstetric provider communicate with the pediatric provider when a neonate has been exposed to HIV. The medical care of an HIV-exposed infant is different than that of an infant who has not been exposed to HIV. In some states, regulations ensure that the obstetric provider's communication of the mother's HIV status to the pediatric provider is not considered a breach of confidentiality.

I. Referral for Follow-up of HIV-infected Mother and HIV-exposed Infant

Both mother and infant need to be referred for ongoing care to providers with experience and expertise in HIV care. Services for families affected by HIV infection are available in many communities through Title IV or Title III of the Ryan White CARE Act. HIV-infected mothers who are just learning their HIV status or who have not been in care need a thorough evaluation of their immune and clinical status and assessment of their need for ARV treatment or other care. Infants need diagnostic testing and clinical monitoring to determine their HIV status. All infants exposed to HIV should be placed on an antibiotic for prophylaxis against *Pneumocystis carinii* pneumonia (PCP) at 6 weeks of age, and should continue to receive it until it has been confirmed that they are not infected with HIV.[20] Families need access to case management and psychosocial support services, ideally through a comprehensive, family-centered HIV program. In some communities, a case manager from the family HIV care program will visit the mother in the hospital if notified of the referral.

Before discharge, the mother should be educated about the ARV prophylaxis and why it is important that the infant complete the full course of medication. Teaching should emphasize that (1) the infant must complete the ARV prophylaxis, (2) the infant should begin taking antibiotic prophylaxis for PCP at 6 weeks of age, (3) the infant will need further testing during the first few months of life to determine HIV status, and (4) the mother should return to receive confirmatory HIV test results (if not received before discharge). If the mother has disclosed her HIV status to a family member or other support person, it is beneficial to involve the support person in instructions about the necessary follow-up care of both mother and infant.

J. Reporting HIV/AIDS

If Western blot or IFA test results confirm HIV infection, the facility must follow all applicable local and state requirements regarding the reporting of HIV infection or AIDS. If personnel are uncertain about the HIV/AIDS reporting requirements in their area, they should contact their state health department HIV/AIDS surveillance unit.

IV. Management Considerations in Developing and Implementing a Facility-based Rapid HIV Testing Protocol for Women in Labor: Preparation and Training

A. Key Players

Training is essential when introducing a new procedure to labor and delivery care. The entire patient care team should be educated about rapid HIV testing during labor. The hospital laboratory staff should be involved in developing and maintaining a quality assurance program.

B. Training of Labor and Delivery Staff--Rapid HIV Testing for Women in Labor

It is essential to provide ongoing training for labor and delivery staff in providing information about HIV infection and rapid testing for women in labor whose HIV status is unknown. Without such training, many nurses, obstetricians, nurse-midwives, residents, and house staff may not have up-to-date information about perinatal HIV transmission or the experience, comfort, or skill to use sensitivity when providing women with accurate information about rapid HIV testing or to perform rapid HIV testing during labor and delivery.

Who should be trained

Training in rapid HIV testing and intrapartum or neonatal ARV prophylaxis to reduce perinatal HIV transmission should be available for all staff who provide care for pregnant women, women in labor, and neonates. These staff members include obstetricians, residents and house staff, family practice physicians, nurse-midwives, labor and delivery nurses, perinatal nurse educators and managers, nurse practitioners, pediatricians, and infection control practitioners.

In nonteaching hospitals, the labor and delivery nurse is the person most likely to assess the woman's medical record for documentation of HIV testing and to provide the woman with information about rapid HIV testing. In teaching hospitals, medical residents, house staff, obstetricians, or nurse-

midwives are most likely to have the responsibility for offering rapid testing. However, the labor and delivery nurse plays an important role in admission assessment, patient teaching, and support.

Content
The training should include the following:

- The failure of risk-based HIV testing to identify HIV-infected pregnant women
- Local, regional, and national HIV/AIDS statistics for women
- CDC guidelines for HIV testing for women in labor
- Factors that influence perinatal HIV transmission
- Interventions to reduce transmission during labor and postpartum
- Short-course ARV prophylaxis for mother and infant
- Strategies to ensure confidentiality
- Approaches to providing information during labor
- Methods for interpreting rapid test results
- Local referrals and follow-up care for the HIV-infected woman and her infant

Training in ARV prophylaxis should include the options for preventing MTCT, strategies for ensuring the availability of medication, specifics of medication administration for mother and infant, and teaching and follow-up for mother and infant.

Teaching strategies and methods for staff: Didactic or independent learning (computer-based or Web-based) works well for HIV statistics, factors that influence perinatal transmission, current research, treatment to reduce perinatal transmission, and specifics about the rapid test.

Case-study discussion in small groups can be the best approach for skill building and problem solving and for exploring attitudes. One or two cases can be discussed in approximately 30 minutes.

Role-playing can be used separately or with case-study discussion to practice discussions about rapid testing of the mother during labor or rapid testing of the infant during the postpartum period. One session of role-playing can usually be completed and discussed in 30?–45 minutes.

Opportunities to provide training
The busy labor and delivery suite does not offer many opportunities for formal in-service training. Thought is needed to present content and make it available at times that are convenient for obstetric staff and providers. Motivation for learning can be increased if CME (continuing medical education) credit and nursing CE (continuing education) contact hours are provided.

In the fall of 2003, CDC funded the Health Research Education Trust, the research and education affiliate of the American Hospital Association (www.hret.org) and the François-Xavier Bagnoud Center (www.fxbcenter.org) to develop model policies, tools, and training materials to assist hospitals and birthing centers implement rapid HIV testing programs in labor and delivery units.

C. Training Essentials for Persons Performing Point-of-Care Rapid HIV Testing

The OraQuick rapid HIV test is used as an illustration of a test that can be performed in the labor and delivery unit. The laboratory, medical, or nursing staff may lead the training session. Including the following suggested points will allow trainees to:

- Review the OraQuick package insert along with the facility's standard operating procedure.
- View the OraQuick rapid HIV antibody testing video
- Observe a demonstration of setting up the OraQuick Rapid HIV Antibody Test
- Perform a panel of 5 known specimens and obtain 100% accuracy
- Take a competency test on the OraQuick rapid HIV test¯100% accuracy or counseling documented for incorrect answers
- The following points should be emphasized as part of training staff to carry out rapid HIV testing:
    - Handle requests for rapid HIV testing stat.
    - Verify that appropriate positive and negative controls have been performed on the lot number in use and match expected results before setting up a patient's specimen.
    - Read the OraQuick Test 20 minutes after setup. Do not exceed 40 minutes. A timer can be clipped onto one's uniform to ensure that the test is read within time limit.
    - Report results as soon as possible (no longer than 60 minutes after receipt of specimen).
    - Document all rapid HIV test results and inform the patient's health care provider according to protocol.
    - Refer all specimens that test preliminary positive to the appropriate laboratory for confirmatory testing.

In October 2003, CDC began to offer a training course called Fundamentals of HIV Testing Using the OraQuick Rapid HIV-1 Antibody Test in various locations throughout the United States. Information about the training and a regularly updated list of the cities can be found at *http://www.cdc.gov/hiv/rapid_testing/*. In early 2004, CDC will partner with the François-Xavier Bagnoud Center to offer regional training specific to perinatal HIV prevention, with emphasis on rapid HIV testing in labor and delivery settings. In addition, to assist with local training, OraSure, for example, offers a short training video about performing the OraQuick HIV-1 antibody test.

D. Ensuring Staff Proficiency and Competency to Carry Out Rapid HIV Testing in Labor and Delivery Settings

Implementation of a rapid HIV testing program is essential to effect the quick (no longer than 60 minutes) turnaround time of results, which is needed to offer timely prophylaxis to women in labor whose HIV status is undocumented but whose specimens are reactive (positive) to the rapid HIV test. All laboratories and testing sites must adhere to the minimum requirements of the Clinical Laboratory Improvement Act of 1988 (CLIA88). Because of the critical clinical implications of this test result, it is of the utmost importance to ensure accurate testing and the reporting of all results. CDC has developed quality assurance guidelines for performing rapid HIV testing, which are available at *www.cdc.gov/hiv/rapid_testing/*.

The keys to successful performance of rapid HIV testing and reporting are

- Clear and concise procedures
- Training of personnel
- Verification of competence of personnel
- Proper performance of quality control procedures
- Recognition of when the testing does not comply with procedures

In a laboratory, these duties would be managed by a Quality Control or Quality Assurance Compliance Officer. In a point-of-care testing (POCT) setting, it is important to establish a POCT coordinator (typically a laboratorian) who is responsible for training, quality control, and quality assurance issues.

One way to assess the capacity of the laboratory or testing site to accurately test and report rapid HIV results is through proficiency testing, "an external program in which samples are periodically sent . . . for analysis." The results from the individual participants are compared to the expected values. Each site receives a graded individualized report and a summary report showing their performance and the performance of all the participants. Proficiency testing is desirable, even for the CLIA-waived OraQuick test, because the decision to administer ARV prophylaxis will be based initially on a single, preliminary positive result. CLIA-certified laboratories and testing sites are required to participate in a proficiency testing program that is approved by the Center for Medicare and Medicaid Services for any test that is not certified by CLIA as waived (e.g., Reveal).

Another mechanism for ensuring the accuracy of test results is continued competency testing of personnel. Competency testing refers to the periodic evaluation of a person's ability to "perform a test and use the testing device." CLIA88 requires each person who is authorized to perform rapid HIV testing that has not been waived by CLIA (e.g., Reveal) and report results to perform competency testing semiannually the first year and at least annually thereafter. Competency testing can take many forms, including performance of the test on known specimens, direct observation, a written examination on the test, and a Web-based competency test. Although this testing is not explicitly required for CLIA-waived tests (e.g., OraQuick), it is recommended to ensure competency, and it is desirable because the decision to administer ARV prophylaxis will be based on 1 preliminary positive result of a rapid HIV test.

For testing done in the labor and delivery unit, the POCT coordinator would keep records of all training and competency verification of personnel, quality control, patient testing, and proficiency testing.

V. Conclusion

Until all HIV-infected pregnant women are tested for HIV infection during prenatal care, the promise of the findings of AIDS Clinical Trials Group Protocol 076, the first study to demonstrate the efficacy of an ARV medication (i.e., AZT) to substantially reduce perinatal HIV transmission, and the findings of other important perinatal HIV prevention studies—that perinatal HIV transmission can largely be prevented and virtually eliminated—cannot be realized. Although efforts are in place to improve access to prenatal care, prenatal HIV testing, and ARV prophylaxis, opportunities to prevent perinatal HIV transmission continue to be missed, and infants acquire HIV infection. The routine use

of rapid HIV testing and medical interventions in labor and delivery settings provides a final opportunity to reduce the effect of those missed opportunities for prevention. It is recommended that **hospitals adopt a policy of routine rapid HIV testing by using an opt-out approach for women whose HIV status is unknown when presenting to the labor and delivery.** It is recognized that implementing rapid testing programs in labor and delivery settings poses challenges. However, clinicians in labor and delivery settings frequently make complex medical decisions, implement emergency life-saving interventions, and discuss sensitive and difficult personal information with patients. This document is intended to assist clinicians by adding another important tool to their repertoire of clinical screening and HIV prevention interventions.

For inquiries or comments, e-mail Margaret A. Lampe, RN, MPH (mlampe@cdc.gov).

Acknowledgments

The working group thanks Drs. Ida Onorato, Marc Bulterys, Harold Jaffe, Alan Greenberg, Patrick Sullivan, Mr. Kevin Delaney, Ms. Marie Morgan, Ms. Thena Durham and Ms. Susan Danner at CDC, Ms. Yolanda Olszewski at the CORE Center in Chicago, Illinois, and Dr. Patricia Garcia at Northwestern University for their thoughtful review and contributions. The working group also thanks the women who have participated in the focus groups, pilots, research studies, and rapid testing programs that have taught many lessons and demonstrated the acceptability, feasibility, and effectiveness of rapid HIV testing during labor and delivery. The knowledge gained from, and the working group's experiences with, these projects were helpful in formulating our approach to this document.

References, Suggested Reading, and Resources

References

1. Office of the Inspector General. Reducing obstetrician barriers to offering HIV testing. 2002. Available at: *http://oig.hhs.gov/oei/reports/oei-05-01-00260.pdf.* Accessed July 10, 2003.

2. Wade NA, Birkhead GS, Warren BL, et al. Abbreviated regimens of zidovudine prophylaxis and perinatal transmission of the human immunodeficiency virus. *N Engl J Med* 1998;339:1409-1414.

3. Shaffer N, Bulterys M, Simonds RJ. Short courses of zidovudine and perinatal transmission of HIV. *N Engl J Med* 1999;340:1042-1043.

4. Fiscus SA, Adimora AA, Funk ML, et al. Trends in interventions to reduce perinatal human immunodeficiency virus type 1 transmission in North Carolina. *Pediatr Infect Dis J* 2002;21:664-668.

5. Guay LA, Musoke P, Fleming T, et al. Intrapartum and neonatal single-dose nevirapine compared with zidovudine for prevention of mother-to-child transmission of HIV-1 in Kampala, Uganda: HIVNET 012 randomised trial. *Lancet* 1999;354:795-802.

6. Moodley D, Moodley J, Coovadia H, et al. A multicenter randomized controlled trial of nevirapine versus a combination of zidovudine and lamivudine to reduce intrapartum and early postpartum mother-to-child transmission of human immunodeficiency virus type-1. *J Infect Dis* 2003;167:725-735.

7. CDC. Revised recommendations for HIV screening of pregnant women. *MMWR* 2001;50(No. RR-19):59-85.

8. Bulterys M, Jamieson D, O'Sullivan MJ, et al. Rapid HIV testing at labor and delivery: a multi-center intervention study. National HIV Prevention Conference; July 2003; Atlanta, Georgia. Abstract T2-G1103.

9. CDC. Approval of a new rapid test for HIV antibody [Notice to Readers]. *MMWR* 2002;51:1051-1052.

10. CDC. Rapid point-of-care testing for HIV-1 in labor and delivery: Chicago, Illinois, 2002. *MMWR* 2003;52:866-868.

11. U.S. Public Health Service Task Force recommendations for use of antiretroviral drugs in pregnant HIV-1-infected women for maternal health and interventions to reduce perinatal HIV-1 transmission in the United States. *MMWR* 2002;51(No. RR-18):1-38. Regularly updated document available at: *http://AIDSinfo.nih.gov.* Accessed October 21, 2003.

12. FDA licensed and approved HIV, HTLV and hepatitis tests. Available at: *http://www.fda.gov/cber/products/testkits.htm*. Accessed July 10, 2003.

13. CDC. 1998 Guidelines for treatment of sexually transmitted diseases. *MMWR* 1998;47(No. RR-1):1-118.

14. Sansom S, Jamieson D, Bulterys M, Farnham P, Fowler M. HIV retesting during pregnancy: Costs and effectiveness in preventing perinatal transmission. *Obstet Gynecol* 2003;102:782-790.

15. OraQuick Rapid HIV-1 Antibody Test [package insert]. Bethlehem, Pennsylvania: OraSure Technologies, Inc. Available at: *http://www.orasure.com/uploaded/331.pdf?134&sec=2&subsec=2*. Accessed October 21, 2003.

16. Reveal Rapid HIV-1 Antibody Test [package insert]. Halifax, Nova Scotia: MedMira Laboratories, Inc. Available at: http://www.reveal-hiv.com/pdf/Reveal_Pa.pdf**.** Accessed October 21, 2003.

17. Capparelli E, Mirochnick M, Dankner WM, et al. Pharmacokinetics and tolerance of zidovudine in preterm infants. *J Pediatr* 2003;142(1):47-52.

18. The International Perinatal HIV Group. The mode of delivery and the risk of vertical transmission of human immunodeficiency virus type 1. *N Engl J Med* 1999.340:977-987.

19. The European Mode of Delivery Collaboration. Elective caesarean-section versus vaginal delivery in prevention of vertical HIV-1 transmission: a randomised clinical trial. *Lancet* 1999;353:1035-1039.

20. Working Group on Antiretroviral Therapy and Medical Management of HIV-Infected Children. Guidelines for the use of antiretroviral agents in pediatric HIV infection. Available at: *http://www.aidsinfo.nih.gov/guidelines/pediatric/PED_012004.html*. Accessed February 2, 2004.

Suggested Reading

Branson B. Rapid tests for HIV antibody. *AIDS Review*. 2000;2:76-83.

Bulterys M, Nolan ML, Jamieson DJ, Dominguez K, Fowler MG. Advances in the prevention of mother-to-child HIV-1 transmission: current issues, future challenges. *AIDScience* [serial online] 2002;2(4). Available at http://aidscience.org/Articles/aidscience017.asp. Accessed November 14, 2003.

CDC. Revised guidelines for HIV counseling, testing, and referral. *MMWR* 2001;50(No. RR-19)1-57.

Fowler MG, Simonds RJ, Roongpisuthipong A. Update on perinatal HIV transmission. *Pediatr Clin North Am* 2000;47:21-38.

Grobman W, Garcia P. The cost-effectiveness of voluntary intrapartum rapid human immunodeficiency virus testing for women without adequate prenatal care. *Am J Obstet Gynecol* 1999;181:1062-1071.

Guay LA, Musoke P, Fleming T, et al. Intrapartum and neonatal single-dose nevirapine compared with zidovudine for prevention of mother-to-child transmission of HIV-1 in Kampala, Uganda: HIVNET 012 randomised trial. *Lancet* 1999;354:795-802.

Institute of Medicine, National Research Council. Reducing the odds: preventing perinatal transmission of HIV in the United States. Washington, DC: National Academy Press; 1999.

Jamieson D, O'Sullivan MJ, Maupin R, et al. The challenges of informed consent for rapid HIV testing in labor. *J Women's Health.* In press.

Kourtis, AP. Prevention of perinatal HIV transmission: current status and future developments in anti-retroviral therapy. *Drugs* 2002;62:2213-2220.

Kourtis AP, Bulterys M, Nesheim SR, Lee FK. Timing of HIV transmission from mother to infant. *JAMA* 2001;285:709-712.

Minkoff H, O'Sullivan M. The case for rapid HIV testing during labor [editorial]. *JAMA* 1998;279;1743-1744.

Mock PA, Shaffer N, Bhadrakom C, et al. Maternal viral load and timing of mother-to-child HIV transmission, Bangkok, Thailand. *AIDS* 1999;13:407-414.

Mofeson M. Tale of two epidemics—the continuing challenge of preventing mother-to-child transmission of human immunodeficiency virus. *J Infect Dis* 2003 ;167:721-724.

Walter EB, Royce R, Fernandez MI, et al. New mothers' knowledge and attitudes about perinatal human immunodeficiency virus infection. *Obstet Gynecol* 2001;26:495-500.

Webber M, Demas P, Enriquez E, et al. Pilot study of expedited HIV-1 testing of women in labor at an inner-city hospital in New York City. *Am J Perinatol* 2001;18(1):49-57.

Resources

CDC Perinatal HIV Prevention Web site. Available at: *http://www.cdc.gov/hiv/projects/perinatal/*.

Includes current CDC perinatal HIV prevention programs, current CDC recommendations and studies on perinatal HIV prevention in the United States, and notices and summaries of national meetings of CDC perinatal HIV prevention grantees.

CDC Rapid Testing Web site. Available at: *http://www.cdc.gov/hiv/rapid_testing/*.

Includes frequently asked questions about rapid HIV testing, official CDC and FDA releases, and studies on rapid tests.

Women and Children with HIV Web site of François-Xavier Bagnoud Center (University of Medicine and Dentistry of New Jersey) and Center for HIV Information (University of California San Francisco). Available at: *http://www.womenchildrenhiv.org/*.

Includes clinical information, training resources, and best-practice recommendations regarding perinatal HIV prevention and pediatric HIV infection. Resources for U.S. and international settings.

The Well Project Web site. Available at: http://www.thewellproject.com.

Includes fact sheets, data sets, summary slides, a searchable database of clinical trials, a resource directory, and a physician network for expert discussion on treatment. Additionally, members will be able to participate in confidential and secure discussion boards; read about real people living with, and successfully managing, HIV; download advocacy tools; and receive a regular e-mail newsletter highlighting the most up-to-date information about women and HIV infection.